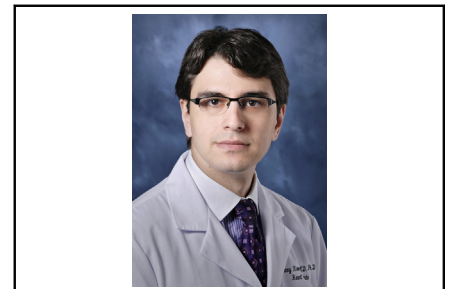


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Commentary: Endoscopic saphenous vein harvesting—Minimally invasive, but potentially fatal

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Since its introduction, endoscopic saphenous vein harvesting has been considered a safe and effective technique for procuring conduit for coronary artery bypass grafting.¹⁻³ Its reduced morbidity and superior cosmetic appearance relative to the open technique led to its wide adoption.¹⁻³ Initial phase discussion focused on outcomes and graft patency. The PREVENT IV^{4,5} and ROOBY⁶ trials, endoscopic harvesting studies, demonstrated reduced graft patency and increased major adverse cardiac events. Meanwhile, the REGROUP⁷ study showed no increase in complication rates. In their 2017 consensus statement, the International Society for Minimally Invasive Cardiothoracic Surgery, reaffirmed that endoscopic saphenous vein harvesting is safe and associated with neither decreased graft patency nor an increase in adverse events.⁸

Despite the broad successes of endoscopic saphenous vein harvesting, however, unforeseen morbidity and mortality associated with its application have emerged. With most of the literature focused on graft patency and cardiac-related morbidity and mortality, it is easy to forget the unique and potentially fatal complications associated with this technology. In the current issue of *The Journal of Thoracic and Cardiovascular Surgery Techniques*, Kawabori and colleagues⁹ and his team provide a case report

CENTRAL MESSAGE

Since its introduction, endoscopic vein harvesting has been considered a safe technique, but carbon dioxide embolus can be deadly. Our surgical community must be vigilant in preventing and treating it.

describing the potential life-threatening complication that can occur with endoscopic harvesting—more specifically, massive carbon dioxide embolus resulting in cardiac arrest. Although not the first to report this complication, Kawabori and colleagues⁹ provide a detailed survey of this potential complication, beginning with diagnosis and proceeding to the corrective clinical steps.

Our cardiothoracic surgery community has become complacent regarding the potential risks of this approach. In another study, Lin and associates¹⁰ concluded that moderate carbon dioxide embolisms occurred in approximately 4% of patients. To illustrate this point, Kawabori and colleagues⁹ describe their coronary artery bypass grafting of a 74-year-old female patient. During conduit harvesting, the patient became bradycardic, and arrest occurred as the result of a massive carbon dioxide embolus, with carbon dioxide seen in every chamber of the heart. Carbon dioxide was even seen in the ascending aorta, because the patient had a patent foramen ovale. The team eloquently and persuasively describes their assessment, with overwhelming evidence demonstrating that the air embolus resulted from carbon dioxide embolization from vein harvesting.

My own surgical team has also noted this problem on occasion and has been careful to identify and treat it aggressively. As described by Kawabori and colleagues,⁹

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immediate heparinization and initiation of cardiopulmonary bypass are lifesaving in cases of cardiac arrest. What is both needed and lacking, however, is a treatment protocol for a moderate or lesser degree of carbon dioxide embolization. For this common contingency, step-by-step management includes rapid heparinization, Trendelenburg positioning, and pharmacologic elevation of blood pressure. The most vital step, however, is the cessation of carbon dioxide insufflation at the earliest sign of right-sided embolization. If cardiovascular collapse progresses, needle aspiration of the right atrium, left ventricle, or aorta can be performed, and rapid institution of cardiopulmonary bypass may ultimately be necessary in extreme cases. Kawabori and colleagues⁹ describe isolating the inferior vena cava and continuing with endoscopic vein harvesting with carbon dioxide insufflation. Although their approach limits the risk of embolization, I recommend conversion to an alternative approach which does not require gas insufflation, such as open harvesting, or deployment of a non-sealed endoscopic system to complete the vein harvesting. The report of Kawabori and colleagues⁹ highlights the importance of vigilance of the cardiac surgical team in identifying and preventing these technical issues before they become life-threatening.

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